IN EUROPEAN PATENT OFFICE
AS INTERNATIONAL PRELIMINARY EXAMINATING AUTHORITY

Application No.: PCT/US2004/008029	)	Confirmation No.
Applicant: WesternGeco Seismic Holding Ltd.	)	
Filed: 17 March 2004	)	Docket No.: 14.0248-PCT

MARINE SEISMIC SURVEY METHOD AND SYSTEM

European Patent Office
P.B. 5818 Patentlaan 2
NL – 2280 HV Rijswijk

Art 34 AMENDMENT

Sir:

This amendment accompanies a demand for international preliminary examination, filed simultaneously herewith. Enclosed are replacement sheet for amended specification and a set of new claims 1-31 to replace the original claims 1-52.

Amendments to the Specification are reflected in the replacement sheet of page 3, which begin on page 2 of this paper.

Amendments to the Claims are reflected in the replacement sheets of pages 67-73, which begin on page 3 of this paper.

Remarks begin on page 9 of this paper.

An appendix with mark-up copy of the amended specification and claims showing changes begins on page 12 of this paper.

noise levels); International Patent Application No. WO 00/20895 (seismic streamer position during a survey according to estimated velocity of streamer position devices); and US Patent No. 6,691,038 (Active Separation Tracking and Positioning System for Towed Seismic Arrays.)

The control systems described above rely upon particular inputs (e.g., marine current) to determine information (e.g., passive streamer shape) useful in controlling a seismic survey towing vessel. None of these systems, however, relies upon or takes into account a broad spectrum of input conditions and parameters that include the various objectives and constraints of the seismic survey equipment and methods. Furthermore, none of these systems seeks to actively control the spread with a coordinated suite of steering devices deployed throughout the spread, including both the sources and receivers. A need therefore exists for such a comprehensive system.

The control systems mentioned above have been designed to achieve desired results by providing outputs, such as commands or paths, for an immediate implementation. There has been little or no consideration in such optimization of the important time-delayed effects of these outputs. A need therefore exists for a seismic survey control system to accounts for time-delayed effects of outputs -- particularly control commands --as well as the immediate effects.

DEFINITIONS

Certain terms are defined throughout this description as they are first used, while certain other terms used in this description of defined below:

"Angle of attack" is the angle of a wing or defector relative to the fluid (i.e., water) flow direction. The angle of attack is a derived quantity, computed from the orientation of the defector for the body of which the wing is attached to the system reference frame, the controllable or fixed orientation of the wing relative to the defectors/body, and the direction of the current in the system reference frame. When the wing/defector has no lift, it has no zero tangle of attack.

1. A method comprising:

collecting input data from a seismic survey spread having a plurality of spread control elements, a plurality of navigation nodes, and a plurality of sources and receivers including:

navigation data for the navigation nodes,

operating states from sensors associated with the spread control elements,

environmental data for the survey, and

survey design data,

estimating positions of the sources and receivers using the navigation data, the operating states, and the environmental data;

determining optimum tracks for the sources and receivers using the estimated positions and a portion of the input data that includes at least the survey design data; and

calculating drive commands for at least two of the spread control elements using at least the determined optimum tracks.

2. The method of claim 1, wherein, the estimating, determining, and calculating steps are performed by a transform function.

3. The method of claim 2, wherein the positions are estimated according to a spread model within the transform function, and the optimum tracks are input to the spread model for calculation of the drive commands.

4. The method of claim 3, wherein the spread model calculates a first set of estimated positions using input that includes at least the operating states and the environmental data, the navigation data includes a second set of estimated positions, and the first and second set of estimated positions are combined with the transform function to produce the estimated source and receiver positions and predicted residuals.

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5. The method of claim 4, wherein the predicted residuals are used to estimate a set of parameters that characterize the spread model, and the spread model parameters are used to calibrate the spread model.

6. The method of claim 4, wherein the predicted residuals are use to estimate error states for sensors used to collect the environmental data.

7. The method of claim 2, wherein the optimum tracks are determined according to a weighting function within the transform function, wherein the weighting function receives as inputs the survey design data and the estimated positions.

8. The method of claim 1, further comprising validating the calculated drive commands and delivering the validated drive commands to the spread control elements, whereby a desirable survey objective may be attained.

9. The method of claim 1, wherein the drive commands include commands for controlling at least one of the vessel propeller, vessel thruster, spread component steering devices, and the vessel cable winches.

10. The method of claim 1, wherein the sensors associated with the spread control elements include one or more sensor types of tension, water flow rate, inclination, orientation, acceleration, velocity, and position.

11. The method of claim 1, wherein the collected environmental data includes one or more data types of current, salinity, temperature, pressure, speed of sound, wave height, wave frequency, wind speed, and wind direction.

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12. The method of claim 1, wherein the survey design data is selected from spread tracks, performance specifications, and survey objectives, wherein the performance specifications are selected from drag and maneuvering characteristics for the vessel, steerable cable devices, steerable source devices, and deflectors, drag characteristic for the towed cables, sources, and floatation devices, and winch operating characteristics.

13. The method of claim 1,

wherein the survey design data includes one or more data types of area, depth, area rotation or shooting orientation, line coordinates, source and receiver positions, required coverage, local constraints, optimizing factors and historical data; and

wherein the collected input data includes one or more data types of pre-survey, operator input, present survey, near-real time, real-time survey, and simulated survey.

14. The method of claim 13, wherein the operator input data includes spread parameter settings and environmental data, and wherein the pre-survey data includes environmental sensor data.

15. The method of claim 13, wherein the real-time survey data includes one or more data types of cable tension, water flow rate, inclination, orientation, acceleration, velocity, position, spread control element setting, environmental data, seismic signal and noise data, and operator input.

16. The method of claim 13, wherein the simulated survey data includes one or more data types of simulated pre-survey, simulated operator input, simulated current survey, simulated near-real time survey, simulated real-time survey, and simulated environmental data.

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17. The method of claim 13, wherein the collected input data further includes raw seismic sensor data, and using the raw seismic sensor data to produce quality indicators for the estimated positions, the quality indicators selected from binning datasets, absolute noise data, signal-to-noise ratios, and seismic signal frequency content.

18. The method of claim 3, wherein the spread model is a hydrodynamic force model of the spread components, a pure stochastic model of the spread components, employing one of the L-norm fitting criteria, or a neural network.

19. The method of claim 18, wherein the force model contains marine current data.

20. The method of claim 3, wherein the spread model is a pure stochastic model of the spread components.

21. The method of claim 3, wherein the spread model employs one of the L-norm fitting criteria.

22. The method claim 3, wherein the spread model is a neural network.

23. A system comprising:

a seismic survey spread while conducting a seismic survey, the spread having a plurality of spread control elements, a plurality of navigation nodes, and a plurality of sources and receivers,

a database for receiving input data for controlling the seismic survey spread including

navigation data for the navigation nodes,

operating states from sensors associated with the spread control elements,

environmental data for the survey, and

survey design data,

a computer readable medium having computer-executable instructions for estimating ~~the~~ positions of the sources and receivers using the navigation data, the operating states, and the environmental data;

a computer readable medium having computer-executable instructions for determining optimum tracks for the sources and receivers using the estimated positions and a portion of the input data that includes at least the survey design data; and

a computer readable medium having computer-executable instructions for calculating drive commands for at least two of the spread control elements using at least the determined optimum tracks.

24. The system of claim 23, is further characterize for performing the methods in any one of the claims 1-22.

25. A method comprising:

towing a plurality of seismic survey spread elements generally behind a vessel having one or more spread control elements;

providing a first set of desired coordinate positions of one or more spread control elements, and independently measuring the coordinate positions of the spread control elements, to form a second set of actual coordinate positions;

differencing the first and second sets of coordinate positions to form residuals; and

using the residuals as set points in controllers calculating drive commands for at least one of the spread control elements.

26. The method of claim 25 wherein at least one of the controllers uses a PID correction method.

27. The method of claim 25 further comprising planning a path for the vessel within a constraint corridor that allows steering available in one or more towed spread control elements to achieve a target shape and track for the spread elements.

28. The method of claim 25 further comprising estimating optimum tracks for tow points of towed spread control elements that provide a cross-line component relative to an optimum track for the towed spread control elements.

29. The method of claim 25 wherein the first set of desired coordinate positions is provided by one or more data types selected from operating states from sensors associated with the spread control elements, environmental data for the survey, and survey design data.

30. The method of claim 25, wherein each of the drive commands is used to control at least one of position, speed, and heading for the vessel.

31. The method of claim 25, wherein the drive commands include commands for controlling at least one of a vessel propeller, a vessel thruster, a vessel thruster setting, a vessel propeller pitch, a vessel propeller rotation speed, a vessel rudder angle, and combinations thereof.

32. A method comprising:

towing a plurality of seismic survey sources and receivers generally behind a vessel having one or more spread control elements;

estimating the positions of the sources; and

selectively activating the sources that are at the proximities of the desired cross line positions.

33. The method of claim 32, wherein the number of selectively activated sources is less than the total number of sources.

34. The method of claim 32,

wherein receivers are towed in a plurality of linear streamers; and

wherein the selectively activated sources form at least one linear source array parallel to the streamers.

35. (new) The method of claim 32, further comprising:

collecting input data from a seismic survey spread having a plurality of spread control elements, a plurality of navigation nodes, and a plurality of sources and receivers

estimating positions of the sources and receivers using the navigation data, the operating states, and the environmental data;

determining optimum tracks for the sources and receivers using the estimated positions and a portion of the input data that includes at least the survey design data; and

calculating drive commands for at least one of the spread control elements using at least the determined optimum tracks.

36. (new) The method of claim 32, wherein the at least one of the spread control elements is a vessel or a spread control element for a receiver.

37. (new) A seismic survey apparatus, comprising:

a vessel;

a plurality of seismic survey sources and receivers generally towed behind the vessel and having one or more spread control elements;

a controller coupled to the seismic survey sources, receivers and the spread control elements, wherein the controller estimates the positions of the sources and selectively activates the sources that are at the proximities of desired cross line positions.

38. (new) The seismic survey apparatus of claim 37, wherein the controller is operable to perform any one of the methods of claims 34-36.

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REMARKS

This amendment accompanies a Demand for international preliminary examination under Article 31 of Chapter 2 of the PCT. The amendment is made pursuant to Art. 34 of Chapter 2 of the PCT.

Amendment of specification

Another prior art reference, US Patent No. 6,691,038, assigned to the same applicant, regarding the state of the art of seismic survey is discovered. It is disclosed and discussed herein. No new matter regarding the invention is added.

Amendment of claims

Please see the mark-up version of the replacement claims for the bases of the amended claims. New claims 25 – 31 are based on the invention described on pages 33-34 about drive command calculation, pages 50-54 about using the residuals for calculating drive command. New claims 32-38 are based on the invention described on page 46 about the source array. The only purpose of the amendment is to more specifically and clearly point out the patentable features of the applicant's invention. None of the amended claims or new claims has gone beyond the disclosure in the international application as filed.

With the above amendments to the claims, Applicant believes the present application is in condition for allowance, which is earnestly solicited. Should the examiner have further questions or concerns, the examiner is invited to telephone the undersigned representative.

Respectfully submitted,

Date: 1/6/2006

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USPTO Registration No. 48,276

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Appendix

Markup replacement sheet showing the changes:

noise levels); [[and]] International Patent Application No. WO 00/20895 (seismic streamer position during a survey according to estimated velocity of streamer position devices); and US Patent No. 6,691,038 (Active Separation Tracking and Positioning System for Towed Seismic Arrays.)

The control systems described above rely upon particular inputs (e.g., marine current) to determine information (e.g., passive streamer shape) useful in controlling a seismic survey towing vessel. None of these systems, however, relies upon or takes into account a broad spectrum of input conditions and parameters that include the various objectives and constraints of the seismic survey equipment and methods. Furthermore, none of these systems seeks to actively control the spread with a coordinated suite of steering devices deployed throughout the spread, including both the sources and receivers. A need therefore exists for such a comprehensive system.

The control systems mentioned above have been designed to achieve desired results by providing outputs, such as commands or paths, for an immediate implementation. There has been little or no consideration in such optimization of the important time-delayed effects of these outputs. A need therefore exists for a seismic survey control system to accounts for time-delayed effects of outputs -- particularly control commands --as well as the immediate effects.

DEFINITIONS

Certain terms are defined throughout this description as they are first used, while certain other terms used in this description of defined below:

"Angle of attack" is the angle of a wing or defector relative to the fluid (i.e., water) flow direction. The angle of attack is a derived quantity, computed from the orientation of the defector for the body of which the wing is attached to the system reference frame, the controllable or fixed orientation of the wing relative to the defectors/body, and the direction of the current in the system reference frame. When the wing/defector has no lift, it has no zero tangle of attack.

Amendments to the claims with markups showing the change. The numbers in parenthesis are the original claim numbers.

1. (currently amended, 1) A method ~~for controlling a seismic survey spread while conducting a seismic survey, the spread having a vessel, a plurality of spread control elements, a plurality of navigation nodes, and a plurality of sources and receivers, the method~~ comprising ~~the steps of~~:

collecting input data from a seismic survey spread having a plurality of spread control elements, a plurality of navigation nodes, and a plurality of sources and receivers including:

navigation data for the navigation nodes,

operating states from sensors associated with the spread control elements,

environmental data for the survey, and

survey design data,

estimating ~~the~~ positions of the sources and receivers using the navigation data, the operating states, and the environmental data;

determining optimum tracks for the sources and receivers using the estimated positions and a portion of the input data that includes at least the survey design data; and

calculating drive commands for at least two of the spread control elements using at least the determined optimum tracks.

2. (original, 2) The method of claim 1, wherein, the estimating, determining, and calculating steps are performed by a transform function.

3. (currently amended, 3) The method of claim 2, wherein the positions are estimated according to a spread model within the transform function, and the optimum tracks are input to the spread model for calculation of the drive commands.

4. (currently amended, 4 and 5) The method of claim 3, wherein the spread model calculates a first set of estimated positions using input that includes at least the operating states and the environmental data, the navigation data includes a second set of estimated positions, and the first and second set of estimated positions are combined with the

transform function to produce the estimated source and receiver positions and predicted residuals.

5. (currently amended, 6 and 7) The method of claim [[5]]4, wherein the predicted residuals are used to estimate a set of parameters that characterize the spread model, and the spread model parameters are used to calibrate the spread model.

6. (currently amended, 8) The method of claim [[5]]4, wherein the predicted residuals are use to estimate error states for sensors used to collect the environmental data.

7. (currently amended, 9 and 10) The method of claim 2, wherein the optimum tracks are determined according to a weighting function within the transform function, wherein the weighting function receives as inputs the survey design data and the estimated positions.

(11. -14. canceled)

8. (original, 15) The method of claim 1, further comprising ~~the step of~~ validating the calculated drive commands and delivering the validated drive commands to the spread control elements, whereby a desirable survey objective may be attained.

(16. -17. canceled)

9. (original, 18) The method of claim 1, wherein the drive commands include commands for controlling at least one of the vessel propeller, vessel thruster, spread component steering devices, and the vessel cable winches.

(19. -21. canceled)

10. (original, 22) The method of claim 1, wherein the sensors associated with the spread control elements include one or more sensor types of tension, water flow rate, inclination, orientation, acceleration, velocity, and position.

11. (original, 23) The method of claim 1, wherein the collected environmental data includes one or more data types of current, salinity, temperature, pressure, speed of sound, wave height, wave frequency, wind speed, and wind direction.

12. (currently amended, 24) The method of claim 1, wherein the survey design data ~~includes~~ is selected from spread tracks, performance specifications, and survey objectives, wherein the performance specifications are selected from drag and maneuvering characteristics for the vessel, steerable cable devices, steerable source devices, and deflectors, drag characteristic for the towed cables, sources, and floatation devices, and winch operating characteristics.

(25. canceled)

13. (currently amended, 26 and 27) The method of claim 1,

wherein the survey design data includes one or more data types of area, depth, area rotation or shooting orientation, line coordinates, source and receiver positions, required coverage, local constraints, optimizing factors and historical data; and

wherein the collected input data includes one or more data types of pre-survey, operator input, present survey, near-real time, real-time survey, and simulated survey.

14. (currently amended, 28) The method of claim [[27]] 13, wherein the operator input data includes spread parameter settings and environmental data, and wherein the pre-survey data includes environmental sensor data.

15. (currently amended, 29) The method of claim [[26]]13, wherein the real-time survey data includes one or more data types of cable tension, water flow rate, inclination, orientation, acceleration, velocity, position, spread control element setting, environmental data, seismic signal and noise data, and operator input.

(30. -32. canceled)

16. (currently amended, 33) The method of claim [[26]]13, wherein the simulated survey data includes one or more data types of simulated pre-survey, simulated operator input, simulated current survey, simulated near-real time survey, simulated real-time survey, and simulated environmental data.

17. (currently amended,34) The method of claim [[26]]13, wherein the collected input data further includes raw seismic sensor data, and using the raw seismic sensor data to produce quality indicators for the estimated positions, the quality indicators selected from binning datasets, absolute noise data, signal-to-noise ratios, and seismic signal frequency content.

(35. -37. canceled)

18. (currently amended, 38 - 42) The method of claim 3, wherein the spread model is a hydrodynamic force model of the spread components, a pure stochastic model of the spread components, employing one of the L-norm fitting criteria, or a neural network.

19. (currently amended, 39) The method of claim [[38]] 18, wherein the force model contains marine current data.

20. (original 40) The method of claim 3, wherein the spread model is a pure stochastic model of the spread components.

21. (original 41) The method of claim 3, wherein the spread model employs one of the L-norm fitting criteria.

22. (original 42) The method claim 3, wherein the spread model is a neural network.

(43. – 48. canceled)

23. (currently amended, 49) A system ~~for controlling a seismic survey spread while conducting a seismic survey, the spread having a vessel, a plurality of spread control elements, a plurality of navigation nodes, and a plurality of sources and receivers, the system~~ comprising:

a seismic survey spread while conducting a seismic survey, the spread having a plurality of spread control elements, a plurality of navigation nodes, and a plurality of sources and receivers,

a database for receiving input data for controlling the seismic survey spread including

navigation data for the navigation nodes,

operating states from sensors associated with the spread control elements,

environmental data for the survey, and

survey design data,

a computer readable medium having computer-executable instructions for estimating ~~the~~ positions of the sources and receivers using the navigation data, the operating states, and the environmental data;

a computer readable medium having computer-executable instructions for determining optimum tracks for the sources and receivers using the estimated positions and a portion of the input data that includes at least the survey design data; and

a computer readable medium having computer-executable instructions for calculating drive commands for at least two of the spread control elements using at least the determined optimum tracks.

24. (currently amended, 50) The system of claim [[47]] 23, is further characterize for performing the methods in any one of the claims 1-22.

~~wherein the position-estimate instructions, the optimum track-determining instructions, and the drive command-calculating instructions are contained in a common computer-readable medium.~~

(51. – 52. canceled).

25. (new) A method comprising:

towing a plurality of seismic survey spread elements generally behind a vessel having one or more spread control elements;

providing a first set of desired coordinate positions of one or more spread control elements, and independently measuring the coordinate positions of the spread control elements, to form a second set of actual coordinate positions;

differencing the first and second sets of coordinate positions to form residuals; and

using the residuals as set points in controllers calculating drive commands for at least one of the spread control elements.

26. (new) The method of claim 25 wherein at least one of the controllers uses a PID correction method.

27. (new) The method of claim 25 further comprising planning a path for the vessel within a constraint corridor that allows steering available in one or more towed spread control elements to achieve a target shape and track for the spread elements.

28. (new) The method of claim 25 further comprising estimating optimum tracks for tow points of towed spread control elements that provide a cross-line component relative to an optimum track for the towed spread control elements.

29. (new) The method of claim 25 wherein the first set of desired coordinate positions is provided by one or more data types selected from operating states from sensors associated with the spread control elements, environmental data for the survey, and survey design data.

30. (new) The method of claim 25, wherein each of the drive commands is used to control at least one of position, speed, and heading for the vessel.

31. (new) The method of claim 25, wherein the drive commands include commands for controlling at least one of a vessel propeller, a vessel thruster, a vessel thruster setting, a vessel propeller pitch, a vessel propeller rotation speed, a vessel rudder angle, and combinations thereof.

32. (new) A method comprising:

towing a plurality of seismic survey sources and receivers generally behind a vessel having one or more spread control elements;

estimating the positions of the sources; and

selectively activating the sources that are at the proximities of the desired cross line positions.

33. (new) The method of claim 32, wherein the number of selectively activated sources is less than the total number of sources.

34. (new) The method of claim 32,

wherein receivers are towed in a plurality of linear streamers; and

wherein the selectively activated sources form at least one linear source array parallel to the streamers.

35. (new) The method of claim 32, further comprising:

collecting input data from a seismic survey spread having a plurality of spread control elements, a plurality of navigation nodes, and a plurality of sources and receivers

estimating positions of the sources and receivers using the navigation data, the operating states, and the environmental data;

determining optimum tracks for the sources and receivers using the estimated positions and a portion of the input data that includes at least the survey design data; and

calculating drive commands for at least one of the spread control elements using at least the determined optimum tracks.

36. (new) The method of claim 32, wherein the at least one of the spread control elements is a vessel or a spread control element for a receiver.

37. (new) A seismic survey apparatus, comprising:

a vessel;

a plurality of seismic survey sources and receivers generally towed behind the vessel and having one or more spread control elements;

a controller coupled to the seismic survey sources, receivers and the spread control elements, wherein the controller estimates the positions of the sources and selectively activates the sources that are at the proximities of desired cross line positions.

38. (new) The seismic survey apparatus of claim 37, wherein the controller is operable to perform any one of the methods of claims 34-36.

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference 14.0248-PCT
International application No. PCT/US04/08029	International filing date *(day/month/year)* 17 March 2004	(Earliest) Priority date *(day/month/year)* 17 March 2004
Title of invention MARINE SEISMIC SURVEY METHOD AND SYSTEM		

Box No. II APPLICANT(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*	Telephone No. 713-689-5799
WESTERNGECO, L.L.C. 10001 RICHMOND AVENUE HOUSTON, TEXAS 77042 US	Facsimile No. 713-689-1977
	Teleprinter No.
	Applicant's registration No. with the Office
State *(that is, country)* of nationality:	State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

WESTERNGECO SEISMIC HOLDINGS LIMITED
P.O. BOX 662
ROAD TOWN, TORTOLA
BRITISH VIRGIN ISLANDS

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

SERVICES PETROLIERS SCHLUMBERGER
42, RUE SAINT DOMINIQUE
F-75007 PARIS
FRANCE

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

☒ Further applicants are indicated on a continuation sheet.

Sheet No. 2.

International application No.
PCT/US04/08029

Continuation of Box No. II **APPLICANT(S)**

If none of the following sub-boxes is used, this sheet should not be included in the demand.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

SCHLUMBERGER CANADA LIMITED
237-4TH AVENUE SW
30TH FLOOR
FIFTH AVENUE PLACE
CALGARY, ALBERTA T2P 4X7
CANADA

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Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

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NORWAY

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PETER TYLER
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UNITED KINGDOM	UNITED STATES

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

☐ Further applicants are indicated on another continuation sheet.

Sheet No. 3

International application No.
PCT/US04/08029

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is [X] agent [ ] common representative

and [ ] has been appointed earlier and represents the applicant(s) also for international preliminary examination.

[ ] is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

[X] is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

LIANGANG (MARK) YE
WESTERNGECO
10001 RICHMOND AVENUE
HOUSTON, TEXAS 77042
USA

Telephone No.
713-689-5799

Facsimile No.
713-689-1977

Teleprinter No.

Agent's registration No. with the Office
48,276

[ ] **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the international preliminary examination **to start on the basis of:**

[X] the international application as originally filed

the description [ ] as originally filed
[X] as amended under Article 34

the claims [ ] as originally filed
[ ] as amended under Article 19 (together with any accompanying statement)
[X] as amended under Article 34

the drawings [X] as originally filed
[ ] as amended under Article 34

2. [ ] The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. [ ] The applicant wishes the start of the international preliminary examination **to be postponed** until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: ENGLISH

[X] which is the language in which the international application was filed.

[ ] which is the language of a translation furnished for the purposes of international search.

[ ] which is the language of publication of the international application.

[ ] which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby **elects all eligible States** *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes **not to elect:**

Sheet No. 4.

International application No.
PCT/US04/08029

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

			For International Preliminary Examining Authority use only: received	not received
1. translation of international application	:	sheets	☐	☐
2. amendments under Article 34	:	19 sheets	☐	☐
3. copy (or, where required, translation) of amendments under Article 19	:	sheets	☐	☐
4. copy (or, where required, translation) of statement under Article 19	:	sheets	☐	☐
5. letter	:	1 sheets	☐	☐
6. other *(specify)*	:	sheets	☐	☐

The demand is also accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ original separate power of attorney
3. ☐ original general power of attorney
4. ☐ copy of general power of attorney; reference number, if any:
5. ☐ statement explaining lack of signature
6. ☐ sequence listing in computer readable form
7. ☒ other *(specify)*: EPO FORM 1010

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

Liangang Yeuk

LIANGANG (MARK) YE

DATE: 1/6/2006

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

CHAPTER II

PCT

FEE CALCULATION SHEET

Annex to the Demand

International application No. PCT/US04/008029

Applicant's or agent's file reference 14.0248-PCT

For International Preliminary Examining Authority use only

Date stamp of the IPEA

Applicant

WESTERNGECO, L.L.C.

CALCULATION OF PRESCRIBED FEES

1. Preliminary examination fee .... 1530 EUR P

2. Handling fee *(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)* .... 159 EUR H

3. Total of prescribed fees
   Add the amounts entered at P and H and enter total in the TOTAL box .... 1689 EUR
   TOTAL

MODE OF PAYMENT

- [x] authorization to charge deposit account with the IPEA (see below)
- [ ] cheque
- [ ] postal money order
- [ ] bank draft
- [ ] cash
- [ ] revenue stamps
- [ ] coupons
- [ ] other *(specify)*:

AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT

(This mode of payment may not be available at all IPEAs)

- [x] Authorization to charge the total fees indicated above.
- [x] *(This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)* Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.

IPEA/ EP

Deposit Account No.: 28300408

Date: Liangang Yeah

Name: Liangang (Mark) Ye

Signature: 01/06/2006

Form PCT/IPEA/401 (Annex) (March 2001; reprint January 2002)

See Notes to the fee calculation sheet

PCT

POWER OF ATTORNEY

(for an international application filed under the Patent Cooperation Treaty)

(PCT Rule 90.4)

The undersigned applicant(s) *(Names should be indicated as they appear in the request)*:

WESTERNGECO, L.L.C.
10001 RICHMOND AVENUE
HOUSTON, TEXAS 77042
USA

hereby appoints (appoint) the following person as: ☐ agent ☒ common representative

Name and address
(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

YE, Liangang (Mark) (Registration No. 48,276)

The applicant hereby revokes the following person:

CHRISTIAN, Steven L. (Registration No. 38,106) as agent and/or common representative from the record

to represent the undersigned before
☒ all the competent International Authorities
☐ the International Searching Authority only
☐ the International Preliminary Examining Authority only

in connection with the international application identified below:

Title of the invention: MARINE SEISMIC SURVEY METHOD AND SYSTEM

Applicant's or agent's file reference: 14.0248-PCT

International application number (if already available):

filed with the following Office United States of America (RO/US) as receiving Office
and to make or receive payments on behalf of the undersigned.

Signature of the applicant(s) *(where there are several applicants, each of them must sign; next to each signature, indicate the name of the person signing and the capacity in which the person signs, if such capacity is not obvious from reading the request or this power)*:

Liangang (Mark) Ye
Attorney-in-Fact
WesternGeco, L.L.C. Liangang Ye

Date: 01/06/2006

Form PCT/Model of power of attorney (for a given international application) (July 1992)

AIR MAIL

WesternGeco

P.O. Box 2469
Houston, Texas 77252-2469

European Patent Office
P.B. 5818 Patentlaan 2
NL – 2280 HV Rijswijk

AIR MAIL